



Impact of Climate Change on Urban Planning in Cities.

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Background

Global urban systems are facing a significant challenge from the impending threat of climate change, which is expected to get worse over the next few decades. Even with continuous efforts to lessen its effects, some of the effects are already noticeable and are predicted to last. The negative impacts of urban heat islands, increased rainfall intensity, storm surges, and flooding are a few of these. It becomes essential to implement effective adaptation techniques to deal with these effects.

In light of climate change, urban planning for the built environment becomes essential to creating and executing flexible solutions for urban systems. The broad use of planning instruments and methods at different scales is essential to the success of urban adaptation. This entails creating design guidelines that give resilience first priority, as well as implementing efficient development management techniques, meaningfully involving stakeholders, and thorough plan-making procedures.

The effects of climate change, which include rising sea levels, harsh weather, and the development of tropical illnesses, present significant obstacles to urban living. These effects have severe financial ramifications and have a negative impact on a number of aspects of urban life, including as housing, infrastructure, health, livelihoods, and basic services. Remarkably, cities account for a significant portion of the world's carbon emissions—roughly 75% come from urban areas. As the main contributors to climate change, buildings and transportation stand out as the main offenders.

A comprehensive approach that addresses the complicated issue of climate change at the global, regional, national, and local levels is necessary. Specifically, cities have a critical role to play in putting effective solutions into practice. Urban areas may play a crucial role in reducing climate change by implementing cleaner production methods, incorporating renewable energy sources, and establishing regulations to curb industrial emissions. This proactive approach promises to improve air quality and decrease pollution, which will benefit city dwellers' health outcomes.

UN-Habitat says, the effects of urbanization and climate change are converging in dangerous ways. Global warming is likely to reach 1.5°C between 2030 and 2052, and approximately 3°C in 2100 based on current national government commitments. This will have disastrous impacts on cities.

According to UN-Habitat, Urban regions are responsible for 71-66% of the world's CO₂ emissions, which makes them a major contributor to climate change. High concentrations of human, financial, and infrastructure assets that are susceptible to the effects of climate change are found in these places. Hundreds of millions of people living in urban areas could be impacted in the next few decades by excessive heat and cold, greater cyclones and storms, inland flooding, rising sea levels, and higher precipitation. Over 90% of metropolitan areas are coastal, putting several big coastal cities with populations of over 10 million already at threat. The quality of life in cities, infrastructure, and availability to essential urban services could all be adversely affected by climate change. The majority of those impacted are the urban poor, especially those who live in impoverished nations' slums, where they frequently experience landslides, pollution, and unstable buildings. Despite these dangers, a lack of pertinent laws and regulations, a sluggish reaction to climate-related disasters, and a lack of public knowledge of climate variability and hazard mitigation have prevented many cities from addressing climate change to date.

Given that over half of the world's population currently resides in cities and that this number will only rise due to demographic trends, the way in which global efforts to address climate change concerns are carried out in the future will be significantly influenced by the state of urbanization.

As of 2005, India has 310 million residents spread throughout approximately 5161 cities, making it the second biggest urban system in the world. Even though less than 30% of Indians live in the country's 5100 urban centers, this percentage is predicted to increase to 40% by 2030 in an estimated 70,000 urban settlements, as the country's urban population is forecast to increase by 575 million during the next 50 years. Seventy Indian cities are predicted to reach a population of one million or more by 2025.

Approach

India's urbanization has grown at an unprecedented rate in recent decades, which has led to further problems with climate change. Cities are more susceptible to the negative effects of climate change as they grow to be the hubs of economic activity. This study examines the necessity of incorporating climate resilience into urban planning, emphasizing the particular difficulties Indian cities confront and offering tactical solutions to lessen and prepare for the effects of climate change.

India is subject to a wide range of climate change impacts due to its distinct climate zones and varied geographical features. Urban areas, being densely populated and hubs of economic activity, are especially vulnerable to severe weather phenomena, temperature increases, and altered precipitation trends. The heat island effect is made worse by increased urbanization, which also messes with the water supply and increases the likelihood of flooding and other climate-related disasters.

The confluence of deteriorating air quality and climate change will present new difficulties for India. Over the past thirty years, India's air quality—which is determined by the amount of gases and particulates, including sulfur dioxide and oxides of nitrogen—has drastically decreased. There are major, immediate health effects of air quality. Air pollution is the leading environmental cause of disease and mortality worldwide, according to the Lancet Commission on pollution and health (Watts et al. 2015). According to the Commission, air pollution causes an estimated 9 million premature deaths worldwide each year.

There are several ways in which the rise in air pollution influences the results of climate change. For instance, these pollutants raise the ground-level ozone layer, harming plant growth and human lungs. (In contrast, the "ozone hole" over Antarctica was deadly because ozone in the stratosphere shields humans from damaging UV light.) Particulates, also known as aerosols, chill the earth's surface by reducing the amount of solar energy that reaches it. This might cause the Indian monsoon to diminish. Moreover, the life cycle of clouds is modified by atmospheric particles. They can cause more intense rainfall events and lengthen the duration of dry spells during the monsoon by changing the size distribution of droplets in clouds.

Climate change is posing unprecedented problems to urban planning in India. The resilience and sustainability of cities are seriously threatened by the frequency of extreme weather events, sea level rise, unpredictable rainfall patterns, and rising temperatures. In order to produce resilient and sustainable urban settings, it is essential to incorporate climate change issues into urban design as India quickly grows more urbanized. This essay examines how climate change is affecting urban planning in Indian cities and argues in favor of a strategy that combines adaptation and mitigation techniques.

Challenges:

- **Infrastructure degradation:** Many Indian cities suffer from antiquated and insufficient infrastructure, which leaves them more vulnerable to stressors associated with climate change.
- **Informal settlements:** As a result of the fast urbanization process, there are an increasing number of unofficial settlements that lack adequate infrastructure and expose vulnerable populations to climate-related risks.
- **Changing precipitation patterns:** Traditional water management methods are put to the test by erratic rainfall and extreme weather, which can result in both droughts and floods.
- **Groundwater depletion:** Excessive groundwater extraction for urban use makes water shortages worse and reduces a city's ability to withstand water stress brought on by climate change.
- **Urban heat islands:** As a result of rapid urbanization, heat islands are created, which exacerbates heat stress and has an adverse effect on the health and wellbeing of city dwellers.
- **Absence of green space:** Cities become hotter and less habitable when there is not enough green space to mitigate the heat island effect.

Strategies:

- **Climate-sensitive zoning:** To promote sustainable land use and lessen sensitivity to climate risks, include climate concerns into zoning regulations.
- **Green infrastructure:** To reduce heat stress and improve urban resilience, encourage the integration of green areas and environmentally friendly infrastructure.
- **Prioritize retrofitting and modernizing current infrastructure** to ensure that it satisfies requirements for climate resilience.
- **Resilient design:** To endure extreme weather events and changing climate conditions, include resilient design ideas into new infrastructure projects.
- **Rainwater harvesting:** To increase water availability and lessen reliance on outside sources, promote the widespread installation of rainwater harvesting equipment.

- Effective water usage: Put policies in place to encourage water conservation and wise use, which will lessen cities' susceptibility to the effects of water on climate change.
- Building inexpensive housing with climate-resilient design elements is necessary to protect vulnerable populations' safety and wellbeing.
- Smart urban planning: Incorporate energy-efficient buildings and smart infrastructure, as well as other smart city ideas that use technology to improve climate resilience.
- Public awareness campaigns: Use awareness-raising to include communities and foster a sense of understanding and resilience to the effects of climate change.
- Building capacity: To increase local governments, planners', and communities' ability to handle climate-related issues, fund training initiatives.

Cities contribute significantly to the GDP of a country or state and are one of the main forces behind economic growth. Additionally, this has positioned them as both climate change contributors and solutions. Cities need their governance structures to prepare for future expansion and to provide basic services and facilities in order to maintain their current rate of growth. Cities, however, frequently find it difficult to handle climate change locally because of the current bottlenecks, which include growing populations, deteriorating infrastructure, bad health, etc. Cities have received support from a number of international and national organizations in the form of financial support, scientific information, policy lobbying, implementation guidance, and technical advice.

The key organizations that are actively engaging with cities in India to support the transition to a climate smart future are:

Multilateral agencies (UN):

Numerous UN agencies have been in charge of various programs that encourage, assist, and facilitate more action on climate change. One of the areas in which these organizations are active is in sustainable urban development that is compliant with the Paris Climate Agreement. UN agencies have been interacting with the urban sector in concert with partners to improve local climate action in cities. The lead UN organization for sustainable urban development and human settlements is the United Nations Human Settlements Programme (UN-Habitat). The focus of UNHABITAT's work in India is on resilient, safe, inclusive, and sustainable cities and regions. Cities all throughout the world, including India, can benefit from using the Guiding Principles for City Climate Action Planning (GPCCAP), which were created to direct city-level climate action planning. Various levels of governance, at both national and sub-national levels, are also being addressed by other UN agencies like the United Nations Environment Programme (UNEP) and United Nations Development Programme (UNDP), in areas like housing, transport, urbanization, heritage, public spaces, environment, climate change, and vulnerability.

Bilateral Agencies:

India's bilateral agencies have included possibilities in their programs to promote sustainable urban development projects, acknowledging this as a critical area of engagement. These organizations collaborate with various parties, including legislators, scholars, think tanks, and civil society, to promote urban sustainability. The type of support offered by bilateral organizations includes funding for climate-smart resilient cities, city-to-city cooperation between Indian and foreign cities, targeted and focused technical assistance to a selected number of cities, assistance with the creation and execution of government initiatives and programs like Smart Cities, financing sustainable infrastructure projects in cities like Metro Rail, Intelligent Transport Systems, Water Supply & Sewage Treatment Facilities, Renewable Energy, Energy Efficiency, etc.

Building India's cities' ability for low-carbon and climate-resilient city development has been the main focus of recent discussions on the changing global climate and cities. International Development Research Centre (IDRC | CRDI), European Union (EU): International Urban Cooperation (IUC), Agence française de développement (Afd), Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) GmbH, Japan International Cooperation Agency (JICA), Swedish International Development Cooperation Agency (SIDA), Swiss Agency for Development and Cooperation (SDC), Foreign, Commonwealth and Development Office (FCDO), and United States Agency for International Development (USAID) are a few of the major bilateral organizations supporting the mainstreaming of climate action in Indian cities.

Think tanks, research institutions and civil society:

In order to help cities make the shift to a climate-smart future and to strengthen their partnerships and capacities for better and informed decision-making in line with national and international urban sustainability goals, think tanks, research institutes, and civil society play a crucial role. The main duties of these organizations include policy analysis, networking, information sharing and awareness-raising, research and advocacy, technical assistance and capacity building, and research. They frequently work together and form partnerships with corporations, international networks, and bilateral and multilateral organizations to make it easier for cities to obtain funding for and carry out sustainable urban development projects.

City Networks:

Several national and international networks that encourage and mobilize citywide climate action. Through the exchange of concepts and experiences, these urban networks give cities the necessary support and inspire action. In addition to influencing national and international policy agendas, these networks facilitate communication amongst local politicians across the globe. In addition, they provide a knowledge library for participating cities and exhibit concepts and solutions from the top cities. The networks concentrate on areas like transportation and urban planning, food, waste & water, energy & buildings, air quality, adaptation and resilience, and food. For instance, more than 1,750 regional and local governments are members of the ICLEI - Local Governments for Sustainability network. ICLEI-South Asia maintains close ties with the municipal administrations of several Indian cities.

Impact of Climate Change and Strategies Used to Mitigate Them

Globally, climate change has become a challenging challenge that has a considerable impact on urban development in Indian cities. The impact of climate change on urban regions is particularly obvious due to fast urbanization and population growth, necessitating a paradigm shift in planning and development techniques.

In order to successfully address the obstacles presented by climate change, cities need to implement innovative urban planning techniques that give priority to sustainability and resilience. It becomes imperative to incorporate climatic considerations into building design, infrastructure construction, and land-use planning. To address increased rainfall, this may entail constructing structures that can endure extreme weather events, implementing sustainable drainage systems, and developing green spaces to lessen the impact of the urban heat island effect.

Urban planning is facing serious issues from climate change in cities all around the world. The physical environment, infrastructure, and social dynamics are all impacted by the complex effects of climate change on metropolitan places. Urban planners must create resilient and sustainable methods to reduce and adapt to these changes as cities struggle with the effects of global warming.

The heightened frequency and intensity of extreme weather events is one of the most noticeable and direct consequences of climate change on urban design. The stability of urban ecosystems is being threatened by factors such as rising temperatures, shifting precipitation patterns, and an increase in the frequency of heatwaves, floods, storms, and wildfires. In order to ensure that infrastructure—such as drainage systems, buildings, and transportation networks—can resist the challenges provided by a changing climate, urban planners must now take these climatic risks into account when developing and renovating infrastructure.

Sea-level rise is another critical concern for cities located along coastlines. Coastal urban areas are at risk of inundation, erosion, and saltwater intrusion, necessitating adaptive measures in urban planning to protect against these threats. This includes the implementation of seawalls, elevated structures, and green infrastructure that can act as natural buffers against rising sea levels.

The implications of climate change also extend to the social and economic fabric of cities. Vulnerable populations, such as low-income communities, are often disproportionately affected by the impacts of climate change. Urban planners must prioritize equitable strategies that ensure all residents have access to resources and opportunities that enhance their resilience. This might involve creating green spaces, improving public transportation, and implementing zoning policies that prevent vulnerable communities from being disproportionately exposed to environmental risks.

In addition, there are significant effects of climate change on energy use and urban heat islands. The urban heat island effect—where cities' concentration of buildings and pavement causes them to endure higher temperatures than the surrounding rural areas—is made worse by rising temperatures. Urban planners are currently investigating novel approaches to reduce heat island impacts and improve energy efficiency, such as green roofs, reflective surfaces, and more vegetation.

Rising temperatures, shifting precipitation patterns, an increase in the frequency and severity of extreme weather events, and sea level rise in coastal areas are just a few of the numerous risks to India's cities brought on by climate change. The infrastructure, general sustainability of cities, and the welfare of urban populations are all directly threatened by these issues. As a result, urban planners are reconsidering established methods and implementing cutting-edge tactics to reduce the effects of climate change and adjust to it.

An essential factor in modern urban planning is the requirement for infrastructure that is climate resilient. Buildings, roads, and other facilities that can survive the effects of extreme weather events including heatwaves, cyclones, and floods are the focus of cities' current efforts. This means identifying susceptible locations and making sure that future developments are located in safe zones by including climate risk assessments into the planning process.

One particularly important aspect of India's climate-sensitive urban development is water management. Increasing water shortages and irregular rainfall patterns drive the adoption of sustainable water management techniques. In an effort to address water-related issues and lessen the burden on traditional water supplies, cities are looking into decentralized water harvesting systems, wastewater recycling, and enhanced stormwater management.

In order to combat rising temperatures and strengthen overall resilience, green areas and urban forestry are becoming more and more important in city development policies. metropolitan heat islands, which are made worse by large expanses of concrete and asphalt, can be lessened by carefully placing vegetation across metropolitan landscapes. In addition to offering shade, parks, green roofs, and roadways lined with trees also help to sequester carbon dioxide, improving air quality and promoting a healthier urban environment.

Climate change factors are causing transportation planning to undergo a radical transformation. Public transportation, cycling, and walking are just a few of the low-carbon, sustainable forms of transportation that cities are actively promoting. By doing this, greenhouse gas emissions are decreased and the transportation infrastructure's overall resistance to severe weather occurrences is strengthened.

The significance of technology in urban planning cannot be overstated. Smart city initiatives leverage data and technology to bolster climate resilience. This includes the implementation of sensors for real-time weather monitoring, early warning systems for natural disasters, and the integration of renewable energy sources into the urban grid.

Briefly said,

Rising Sea Levels and Coastal Cities:

Climate change has led to rising sea levels, impacting coastal cities. Urban planners must consider the risk of flooding and erosion, leading to the need for resilient infrastructure, elevated buildings, and effective drainage systems to safeguard coastal communities.

Extreme Weather Events:

Climate change is causing heatwaves, storms, and other extreme weather phenomena to occur in cities more frequently and intensely. The integration of green infrastructure, sustainable architecture, and emergency preparedness is crucial in urban planning to alleviate the adverse effects of natural disasters on urban inhabitants.

Urban Heat Island Effect:

The urban heat island effect, in which cities get noticeably warmer than the surrounding rural areas, is exacerbated by climate change. To mitigate this effect and improve the general livability of urban surroundings, urban planners are implementing cool roofs, green spaces, and reflective materials in construction.

Water Scarcity and Drought:

Cities' access to water is impacted by extended droughts and shifting patterns of precipitation. To provide a reliable and secure water supply for inhabitants, sustainable water management techniques including rainwater collection, effective irrigation systems, and water recycling must be incorporated into urban development.

Energy Efficiency and Carbon Emissions:

Urban planning techniques should place a high priority on lowering carbon emissions by encouraging the use of renewable energy sources, energy-efficient structures, and public transportation. By reducing the amount that cities contribute to climate change, sustainable urban design may make cities more resilient and ecologically friendly.

Integration of Climate Change into Urban Planning

Mitigation Strategies:

Mitigation techniques should be given priority in urban design in order to address the underlying causes of climate change. This entails expanding green areas, decreasing carbon emissions, and supporting sustainable transportation. To reduce their carbon footprint, Indian towns must switch to renewable energy sources and use energy-efficient construction designs.

Adaptation Measures:

The infrastructure that urban planners create must be flexible enough to withstand the effects of climate change. This covers improved water management techniques, climate-smart transportation systems, and resilient construction. Furthermore, thoughtful planning should go into creating urban green areas that serve as barriers against flooding and extremely high temperatures.

Green Infrastructure:

Cities may become more resilient by implementing green infrastructure, such as parks, urban forests, and green roofs. In addition to reducing the impact of the urban heat island, these features also act as carbon sinks and give locals access to recreational areas.

Smart Urban Planning:

Climate resilience in urban development necessitates the use of technology. Smart city projects can reduce energy use, manage trash better, and increase the effectiveness of transportation. Cities may become more resilient and sustainable through the use of innovative technology and data analytics to assist intelligent urban development.

Community Engagement and Capacity Building

Inclusive Planning:

Inclusion and community involvement should be given top priority in climate-resilient urban design. Participating local communities in the decision-making process guarantees that urban plans take into account the demands and vulnerabilities of the populace, as they frequently have significant knowledge about their surroundings.

Capacity Building:

It is essential to increase local governments', planners', and communities' understanding of and ability to adapt to climate change. Workshops and training sessions can provide stakeholders the knowledge and skills they need to develop and carry out winning plans.

Policy Reforms**National and Local Policy Alignment:**

For effective climate action, national and local policies must be coordinated. A coherent approach to climate resilience is ensured by incorporating climate considerations into currently in place urban planning strategies, such as master plans and zoning rules.

Incentives and Regulations:

Governments ought to enact laws requiring climate-resilient infrastructure and offer incentives for sustainable development methods. Penalties, tax incentives, and subsidies are all useful instruments for promoting adherence to climate-friendly urban development.

Conclusion

In summary, the effects of climate change on India's metropolitan areas present serious issues that need for quick decision-making and all-encompassing solutions. The nation's cities are now more susceptible to extreme weather, rising temperatures, and water-related problems due to the increased urbanization of the country. The sustainability and resilience of Indian cities are under threat from the effects of climate change, which include rising sea levels, altered precipitation patterns, and the urban heat island effect.

To address these challenges, a multifaceted approach is required, encompassing mitigation and adaptation strategies, policy reforms, community engagement, and capacity building. The following key points summarize the crucial aspects of this comprehensive approach:

Mitigation Strategies:

- Give energy-efficient building designs and renewable energy sources a priority to cut carbon emissions.
- To reduce cities' overall carbon footprint, increase green spaces and environmentally friendly transit.
- To reduce reliance on carbon-intensive modes of transportation, promote the use of walking, bicycling, and public transportation.

Adaptation Measures:

- Provide robust infrastructure—including better water management systems—that can survive the effects of climate change.
- Use transportation options that are climate-smart and resilient to extreme weather.
- Incorporate strategic planning for urban green areas that act as buffers against high temperatures and flooding.

Green Infrastructure:

- In order to mitigate the urban heat island effect and serve as carbon sinks, green infrastructure features such as parks, urban forests, and green roofs should be implemented.
- Increasing a resident's ability to access leisure spaces will improve their quality of life.

Smart Urban Planning:

- Use technology and data analytics in smart city initiatives to lower energy use, improve trash disposal, and boost the effectiveness of transportation.
- Adopt cutting-edge technologies to promote sustainable development and intelligent urban planning while promoting climate resilience.

Community Engagement and Capacity Building:

- Putting local communities' unique needs and vulnerabilities first through their participation in decision-making processes would help to prioritize inclusive planning.
- To help local governments, planners, and communities better understand and be able to adapt to climate change, hold workshops and training sessions.

Policy Reforms:

- To guarantee a cogent and successful approach to climate resilience in urban development, harmonize national and local policy.
- Pass legislation requiring the construction of climate-resilient infrastructure and offer financial rewards, tax breaks, and other incentives to encourage the adoption of sustainable development strategies.

The involvement of multiple stakeholders, such as think tanks, research institutes, citizen networks, international and bilateral organizations, and city networks, is crucial in the Indian setting. These organizations are able to assist cities in their shift to a climate-smart future by offering financial support, scientific data, policy advocacy, implementation help, and technical advice.

The joint efforts of policymakers, urban planners, communities, and foreign organizations will ultimately determine the success of climate-resilient urban planning in India. India has the potential to construct cities that are not only economically dynamic but also climate change resilient through the adoption of creative solutions, encouraging community engagement, and coordinating policies across various governmental levels.

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